Vol 15 No 4 November 1974

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AIR FORCE Civil Engineer

Air Force Engineering & Services Quarterly

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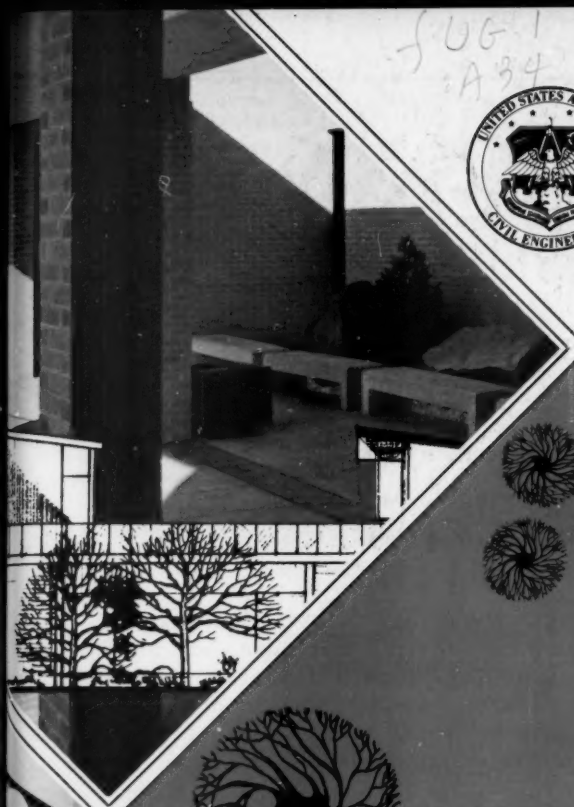
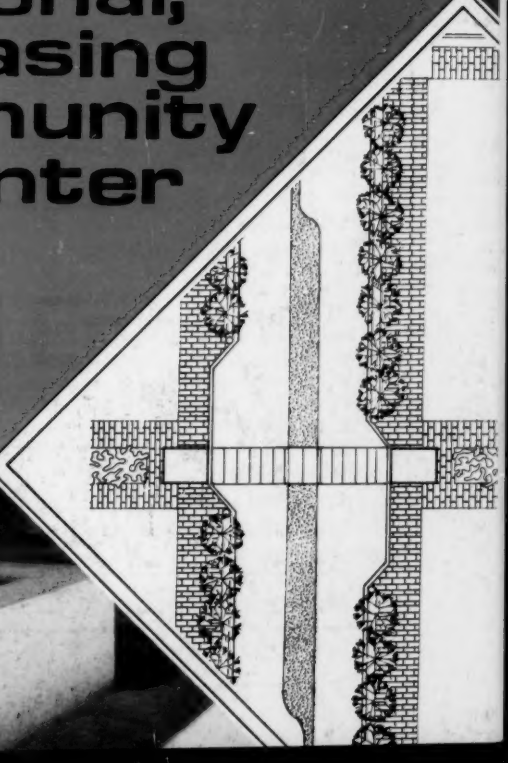


Creating the Functional, Pleasing Community Center



AIR FORCE Civil Engineer

USAF RECURRING PUBLICATION CE 85-1 VOL 15 NO 4 NOVEMBER 1974

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The **AIR FORCE CIVIL ENGINEER** is an official nondirective Headquarters US Air Force publication published quarterly under provisions of Chapter 2, **AFM 5-1.** Its purpose is to provide Air Force Civil Engineers with a timely and comprehensive picture of the importance, wide ranging involvement and direct relationship of civil engineering activities to successful accomplishment of the Air Force mission. It provides current information about significant civil engineering programs and accomplishments throughout the Air Force; pertinent developments in science engineering and management; and educational/training opportunities for enhancing professional thought and development. The Journal is edited and published by the Civil Engineering School, Air Force Institute of Technology. Contributions, suggestions and criticism are welcome. Opinions expressed do not necessarily reflect the official viewpoint of the Department of the Air Force, the Director of Civil Engineering or the editorial staff. DISTRIBUTION: F. The Journal's annual subscription prices are: $2.10 domestic: $2.70 foreign.60 cents per copy. Mail check or money order to Superintendent of Documents: Government Printing Office, Washington, D.C. 20402.

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CURRENT EMPHASIS

Information published here is designed to keep civil engineering personnel aware of late developments and significant trends within the career field.

MAXIMUM UTILIZATION OF FAMILY HOUSING--Family quarters utilization currently receives high visibility within the Air Staff and OSD as a result of the 31 December 1973 shortfall of the DOD-prescribed utilization target of 98% for adequate housing. In May 1974, Headquarters asked MAJCOMs to place command emphasis in assuring maximum utilization of all family quarters. Someone got the message. As of 30 June 1974, the Air Force exceeded the prescribed utilization target by 0.6% and the 93% target for substandard quarters by 5.43%. Continued vigilance is necessary.

STUDY OF STATIC ELECTRICITY IN POL SYSTEMS--The Air Force, under contract with Exxon Research and Engineering Company, is studying the generation, dissipation and control of static electricity in fuel/distribution systems. The study involves the collection of instrumented data at Air Force facilities and is designed to permit a better understanding of the prevention of explosions/fires ignited by static discharges. Completion is scheduled for June 1975.

AFR 93-5 "AIRFIELD PAVEMENT EVALUATION PROGRAM"--This regulation reflects changes in responsibility and control of the airfield pavement evaluation program resulting from the organizational change of the Civil Engineering Center from Headquarters US Air Force/Civil Engineering Center to Air Force Systems Command. Program management has been shifted to the Engineering Division at Headquarters; the airfield pavement evaluation technical functions remain with the Civil Engineering Center.

CONSTRUCTIBILITY REVIEW OF PLANS AND SPECIFICATIONS--An all MAJCOM letter dated 28 August 1974 emphasized the importance of a review of final plans and specifications by the construction manager. The review should be oriented toward elimination of obvious design deficiences that have a deleterious impact on construction cost and time.

CONTROLLER CONCEPT--Recent IG and PRE staff visits have indicated that the Controller Concept is not fully meeting the objectives outlined in Chapter 1, AFR 85-1. Several MAJCOMs have been requested to conduct a special industrial engineer study pertaining to the concept with particular emphasis on cost effectiveness and the need for positive work force control. Studies, containing comments from 25 installations, have been received and are being evaluated. Results will be available upon completion of the study.

SOLID WASTE MANAGEMENT--Guidelines for Thermal Processing and Land Disposal of Solid Waste were published by the Environmental Protection Agency last August. Implementation of these regulations is mandatory for all Federal agencies.

CONTRACT AWARD OF FY 74 MILITARY CONSTRUCTION PROGRAM--MAJCOMs and Regional Civil Engineers are to be commended for a fine effort in awarding approximately 56% of the FY 1974 MCP by 30 June 1974. Bids were opened on an additional 22% of the program but could not be awarded because of high bid prices. Analysis indicates that complete and accurate Project Books followed by close coordination between the AFRCE and MAJCOMs throughout the design cycle are the prime ingredients to success.

MINOR CONSTRUCTION (P-341) PROGRAM--The increasing number of P-341 projects being submitted for approval cannot be accommodated with the funds available. The total of approved, unfunded projects carried over from FY 1974 to FY 1975 plus unapproved projects now in Headquarters US Air Force exceed the total appropriations requested for FY 1975. Accordingly, all project submittals must positively comply with the intent of 10 U.S. Code 2674.

NOISE EXPOSURE FORECAST PLOTS--The Civil Engineering Center has begun producing noise exposure forecast plots of Air Force bases under the Air Installation Compatible Use Zone program. Myrtle Beach AFB, South Carolina, the first base for production, was started in August. About three plots per month will be accomplished according to priorities established by Headquarters US Air Force.

CONTRACT MANAGEMENT--Base Civil Engineering organizations with designated Technical Representatives of the Contracting Officer (TRCOs) should review AFR 70-9 to ensure that TRCOs are receiving training and that checklists are developed to assure proper contract surveillance.

ENERGY CONSERVATION MCP--OSD, recognizing the national urgency for energy conservation, has allocated a substantial amount of money to the military departments for MCP projects to conserve energy. All MAJCOMs have submitted their projects in response to this program and they are included in the FY 1976 President's budget now under review at OSD.

STATUS OF REGS AND MANUALS--Copies of AFR 85-19, Maintenance and Operation of Electric Power Generating Systems, and AFR 91-5, Utilities Services, are now available. AFR 88-13, Selecting Architect-Engineer Firms for Professional Services by Negotiated Contracts, which supersedes AFR 88-17, is currently under final review and should be in the field by the end of the year. A forthcoming change to AFM 86-2, Standard Facility Requirements, will bring the entire inventory of facilities under a comprehensive criteria development management system. For the first time, the new system defines command responsibilities for MAJCOM-unique facilities.

NAVIGABLE WATERS DEFINED--Developers and users of oil spill plans should know this includes "the entire riverine system in the United States as well as any artificially created water bodies leading to the riverine system, that is, storm drains, seasonally dry canals, ditches, etc."

IMPROVED GRASS CUTTING EQUIPMENT--TA 008--An allowance for a new type mower, FSN 3750-194-7944, has been included in TA 008. Future purchases should be for the new type mowers.

YOUR CHANCE TO SPEAK OUT--Elsewhere in this issue of the Journal is a readership survey form. Please read it, fill it out and drop it in the nearest mailbox. Each response received will go a long way in helping us to determine just what kind of information you want us to publish. Reproduce the form and ask your fellow civil engineering co-workers to send in their responses. Do it today!

IMPACT OF STATUTORY FUNDING LIMITATION ON THE MFH PROGRAM--Execution of MFH programs are constrained by statutory funding limitations established by public law. In view of inflationary trends and rising construction costs, these constraints make it necessary for everyone involved in the design and construction process to exercise firm control and make the hard decisions necessary to insure that the quality of materials selected for inclusion in the design do not exceed realistic requirements. It is equally important during construction to prudently allocate and manage the dollars available for SIOH and contingencies to minimize cost growth and preclude violation of public law.

One of the beneficial factors affecting the morale of the military community is efficient exchange service. Here's the report on how the Army and Air Force Exchange Service works toward the goal of . . .

Retail Store, Ent AFB, Colorado.

Shopping Center, Peterson Field, Ent AFB, Colorado.

Creating the Functional Pleasing Community Center

by Col Robert W. McBride

About two years ago, Headquarters Army-Air Force Exhange Service (AAFES) produced a new poster for Army and Air Force exchanges to display to customers: "Please excuse the inconvenience while we make improvements to serve you better." The need for such a poster is an indicator of the energetic AAFES facility improvement program, an important segment of which is the AAFES-funded construction of new exchange facilities—from snack bars to main retail stores and shopping centers. AAFES believes that modern, adequately sized facilities are essential in achieving its basic mission which is to provide exchange service to authorized customers and to generate reasonable earnings in support of Army and Air Force welfare and recreational programs. Exchange service has long been recognized as one of the beneficial factors affecting the morale of the military community. The new facilities provided by the AAFES construction program buttress that contribution to the nation's armed forces.

New construction is only one element of the AAFES annual capital expenditure program. That program also provides funds for interior decor, equipment, and motor vehicles, as well as for rehabilitation of structures where warranted in lieu of new construction. The AAFES worldwide program is managed by the Engineering Division of the AAFES headquarters in Dallas. Engineering offices are also established at the five AAFES regional offices in the US to implement AAFES repair and maintenance policies and to develop small facility improvement projects. The oversea exchange systems (European, Pacific, and Alaska) have their own engineering staffs responsible for maintaining and improving facilities in their areas in accordance with policies, procedures and standards developed by the Engineering Division in Dallas. All new construction, however, is planned and usually implemented by the Dallas engineers.

The Engineering Division comprises four branches:

Engineering Management Branch which primarily is responsible for administration of the AAFES capital expenditure program including the processing of AAFES-funded projects requiring approval by HQ AAFES, and for promulgation of AAFES engineering policies and procedures.

Standards and Criteria Branch which develops standards for architectural treatment, and for policies and procedures for the repair and maintenance of equipment and facilities.

Consultant Services Branch which identifies requirements for exchange facilities, plans and designs renovation projects, and plans new construction of facilities, including the development of definitives.

Construction Branch which manages the new construction program, and the development of design guidance and architectural concepts.

AAFES engineers must integrate two, not always entirely compatible forces:

- Departmental construction standards which must be adhered to, and
- New, proven merchandising methods and design improvements from the private sector.

These factors must be interwoven into the basic

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Creating *cont'd*

AAFES objective of providing attractive, efficient facilities without plushness.

AAFES instructions on facilities programming state that exchange facilities must be geared to the premise "that the military customer is sophisticated, well informed, and intelligent; that he is as discriminating in his taste and wants as the most demanding of American consumers; that he is by no means a captive consumer; that he wants dignified, courteous service, a reasonable choice in quality merchandise and services, and the assurance he is getting full value for his money."

AAFES engineers are also faced by the constraint that the new construction program must be self-regenerating. New facilities must not only avoid any drain on the limited resources available to AAFES but must also produce the additional income required to fund continuation of the new construction program. As a result, each project must be engineered to a cost compatible with the fiscal return on the AAFES investment, with the key factor being the sales projected over the economic life of the project. Consequently, each new construction proposal is

Entrance to Main Retail Store, George AFB, California.

submitted to a sophisticated fiscal evaluation widely used in private industry, in which the "pay out" (degree of risk) and "return" (degree of profitability) is calculated. Other than in exceptional cases with overriding considerations, project proposals which do not meet AAFES pay out and return criteria are either downscoped, deferred or disapproved.

To verify the sales projections and other factors used in the pay out and return calculations, AAFES also makes after-the-fact evaluations annually on each new construction project, beginning one year after the facility has opened for business. (AAFES has been accused on several occasions of being profit-minded. AAFES is, in fact, service-minded but has found that, in the absence of appropriated funds for the purpose, the only means of funding new stores to provide better service is to build profitable stores.)

AAFES engineering and architectural design standards for new exchange facilities and related equipment have been developed in consonance with the DOD Construction Criteria Manual, commercial standards, and accumulated experience. Because AAFES facilities have a use factor of at least twice that of any similar commercial outlet, special design standards for materials, finishes and equipment have been developed to satisfy the durability and aesthetic requirements at reasonable cost. These standards cover virtually every functional aspect of the design from the foundation to the dedication plaque. Additionally, explicit guidance has been developed for the preparation of construction drawings, specifications, design analysis and cost estimates.

Standard definitive layout plans have been developed over a period of years for various sizes of main stores and other exchange facilities. The latest changes include the additon of a retail warehouse contiguous with main retail stores, snack stand at the entrance of shopping center complexes, and the mall concept (arrangement of the entrance to the main store, services outlets and snack bar around an interior mall). For specific projects, these standard drawings are supplemented with a soil investigation report, topographic survey, site plan, utility drawings, reflected ceiling drawings, equipment layouts, and a complete equipment listing with utility requirements for the retail outlet, warehouse, offices, services outlet and food outlet.

The design "package" that is assembled from the equipment/materials standards, definitive and specific drawings, soils and topographic data, and design guidance has been described by contract AE firms as the most comprehensive and explicit available anywhere. As a result, the design time is considerably shorter than for a comparable commercial project (AAFES allows a total of 90 calendar days for AE design) and the AAFES engineering management of the design is minimized with positive controlled results.

The dedication to standardization by AAFES engineers produces commonality in facility operations, interchangeability of equipment, durability, and a pleasing environment for customers. Experience in the program also reveals that operating and maintenance costs are lower and that construction costs compare favorably with similar commercial buildings. Further, as a result of AAFES project cost control, cost growth during construction averages less than four percent of the construction contracts, a remarkably low figure for the industry considering that this percentage includes modifications due to operational changes rather than just errors or omission in the construction documents.

Other techniques involved in cost-reduction measures include site adaptation of construction documents to a new location and the concurrent design of two or more similarly sized facilities. In various stages of construction are major shopping complexes at Sheppard, Bergstrom, Chanute, and McChord Air Force Bases, all designed concurrently by a single AE firm.

The grouping of main retail, food and personal services outlets in a consolidated configuration located within a base community center is a primary AAFES facility objective. Accordingly, AAFES engineers have focused on the detailed planning of community centers. Through experience, AAFES has developed planning principles which lead to functional relationships between the exchange, commissary, bank, credit union, bowling alley and other tenants of a community center, integrated into a total, appealing environment. Although the exchange facilities may not be the first structures constructed in a community center, it is AAFES practise to develop proposals for and participate in the planning of the integrated layout of the entire center well in advance of the start of work on the center. This insures that the exchange facility site is unencumbered when AAFES construction starts and is in proper relationship to other facilites at the center. Early planning efforts by AAFES and installation planners have repeatedly resulted in coordinated community center master plans, allowing orderly phased construction toward a common goal: a functional pleasing community center.

The need for an AAFES new construction project may be identified by the Dallas headquarters, an oversea exchange system or CONUS exchange region, the exchange itself or the command served by the exchange. After the Consultant Services Branch has completed preliminary development of the project, it is presented to the Board of Directors, whereupon the project moves to the Construction Branch for implementation.

Under the guidance of the Construction Branch professional staff representing all the architectural and engineering disciplines, each project is designed by contracted commercial AE firms and constructed by contractors selected by competitive solicitations. In addition to continuous surveillance of design and construction, the Construction Branch selects all operating equipment and furnishings, and supervises their installation by separate contract. Professional services, construction and equipment are procured by AAFES contracting specialists in the Dallas headquarters.

A simplified scenario of the many steps taken in the development of an AAFES project is provided by review of the new community center at Norton AFB, California where a new main store, service facilities and snack bar were constructed. In 1968 the Norton AFB Exchange, in coordination with the exchange region and AAFES engineers, and in collaboration with the Base Civil Engineer, developed its Exchange Facility Master Plan for long-range exchange facility requirements at the base. The need for a new shopping center complex was identified for construction in 1973 or 1974.

The master plan was approved by the Norton AFB commander and sent to the Military Airlift Command for assurance that the planned construction was in consonance with the command's future plans for the base. A copy of the master plan was sent to the Dallas headquarters where data was incorporated into AAFES new construction program processes.

Based on projected patronage at the new facility, AAFES engineers applied Departmental space criteria to determine the size of the proposed main store (35,300 SF), individual services outlets, and snack bar to be included in the complex. Project data was compared with those for other construction proposals and a priority was assigned—a relatively high priority, with construction to start during the fall of 1972.

Actual planning commenced in May 1969 when a team of AAFES engineers visited the base to review the Community Center Master Plan and survey the site. During the visit, the team evaluated topography and soil conditions, access roads, traffic flow and availability of utility lines. Based on the team's findings, the Consultant Services Branch developed preliminary site plans indicating the location of all facilities already constructed or planned for the Norton AFB community center. The site plans were coordinated with the base and major commands. Concurrently, the AAFES staff studied other factors, including the architectural style of buildings at Norton AFB to assure that the new exchange complex would be compatible with other facilities.

By early 1970 the Consultant Services Branch had completed preliminary plans and cost estimates for the construction and had coordinated the proposal with common engineers. The project was sent to the Board

Checkout Area, March AFB, California.

of Directors for approval in principle, which was granted. Since the scope of the project required Departmental approval and prior reporting to the Congress, the necessary documentation was dispatched to the Department of the Air Force. The project moved to the Construction Branch for design and construction.

Through careful programming and scheduling, a similar project for March AFB had been concurrently developed to coincide with implementation of the Norton AFB project. The two projects were integrated into a single design package and the Dallas headquarters engaged a Southern California AE to prepare construction documents. Except for foundations, utilities and site work, identical documents were

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Customer Service Area at Norton AFB, California.

Sports Department at Main Retail Store, Lowry AFB, Colorado.

A SHOWCASE OF NEW FACILITIES

Covered Walkway from Snack Bar to Main Store, Andrews AFB.

View of Snack Bar, Davis-Monthan AFB, Arizona Shopping Center.

Shopping Center, March AFB, California.

Creating *cont'd*

developed for both projects.

AAFES and command engineers reached an agreement on the final plans. In late 1972, the Dallas headquarters requested construction proposals from contractors who were asked to submit offers for either project individually or for both combined. Concurrently, AAFES identified the latest construction cost estimates to the Board of Directors and obtained a final "go" on the project. Contractors' proposals were examined, and a single construction contract was awarded at a lower cost than would have resulted from award of two contracts.

Ground was broken in November 1972. Construction work was inspected by the AE firm that designed the facility, with AAFES engineers providing overall surveillance. Concurrently, the Construction Branch staff worked with AAFES procurement specialists to order retail fixtures and equipment and AAFES merchandisers planned display of the stock. Since March and Norton are located in Southern California, weather permitted year-round construction. In September 1973, while final touches were being applied by the construction contractor, fixtures were put in place and the merchandise was arranged. The new main store for March AFB opened in October and the Norton AFB main store opened on 21 November.

AAFES engineers completed 23 new construction projects in 1973. Some of them involved more than the usual type of problems encountered in construction. For example, at Andrews AFB, the exchange shopping complex was the first unit of a new community center; AAFES engineers formulated the concept for the entire center. Since Andrews AFB is within the area where construction on government property requires approval by the National Capital Planning Commission (NCPC), a lengthy process was necessary to obtain the concurrence of that body. To comply with NCPC requirements, AAFES engineers undertook a considerable amount of landscaping. Poor soil conditions at the construction site necessitated the removal of a considerable amount of soil and replacement with stable material to provide an adequate foundation for the parking area. The shopping center at Andrews AFB features pre-cast concrete panels for all facia and columns, with handsome brick walls alternated along the exterior. Other architectural attractions include a columnade and walkway between the main retail store and snack bar, and a sunken plaza for outdoor public use by military personnel.

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Building and building improvements constructed with AAFES funds do not remain AAFES property. Once construction is completed on a military installation, title to the structure or building improvement passes to the military department concerned. While in-fact government property, AAFES-funded buildings are designated exchange facilities and cannot be utilized for any other purpose without prior approval by the Commander, AAFES and the military department. As with any other government property, it is an appropriated fund responsibility to repair and maintain the basic structure, real property installed equipment including heating, ventilating, and air conditioning systems, utility lines, surrounding walks and roadways, and parking areas, as well as to maintain the associated landscaping.

173 Projects Completed Since 1964

AAFES has completed 173 projects since 1964. Of these, 26 were main retail stores and 51 were multiple facilities (for example, main store, services outlets, contiguous warehouse and snack bar). Projects in work include 29 under construction; 5 being solicited; and 32 under design. AAFES engineers estimate that they have reached the midpoint of facilities warranting replacement and that another $170 million is still required for identified deficiencies, with that figure expected to climb with inflation.

It is not news that AAFES is faced with economic problems. Some of them are common to the retail industry, resulting from rising wage costs, general inflation, the energy crisis, and so on. Other problems are peculiar to the nature of exchange operations, such as the reduction in military strength and the devaluation of the dollar in oversea areas. The economic situation may adversely affect the availability of AAFES funds for construction of exchange facilities. Nevertheless, it is difficult to envision withdrawal from a construction program that has proven so successful and which contributes significantly to attainment of the long-rang objectives of the Exchange Service mission.

AAFES engineers are also well aware that AAFES new construction is a limited program, targeting on main exchange facilities located for the most part in community center areas. Of equal concern are the numerous retail annexes, barber shops and other service outlets, and small food outlets located in the more remote areas of the installations. Worldwide, AAFES operates more than 16,000 activities located in almost 5,000 facilities. Many of those facilities need improvement, if not outright replacement. It is essential that appropriated funds continue to be programmed in military construction programs for branch exchanges. It is equally essential for BCEs to continue the high level of authorized maintenance and repair support that has kept exchange facilities suitable for operation. CE

Directorate Establishes New Division

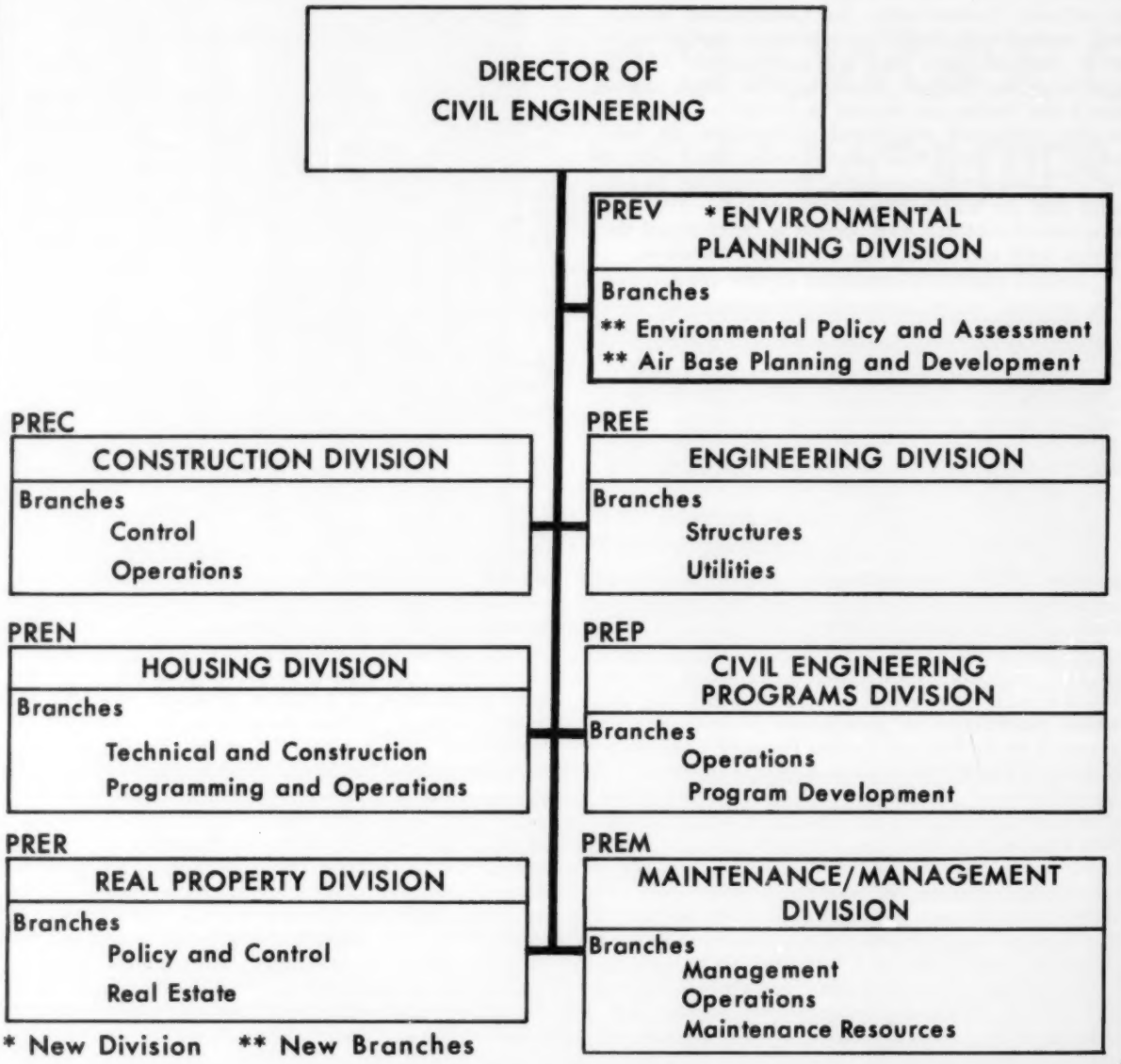
A new Environmental Planning Division was established within the Directorate of Civil Engineering, Headquarters US Air Force, on 1 September 1974. The new division has two branches:

- **Air Base Planning and Development,** and
- **Environmental Policy and Assessment.**

This organizational adjustment unifies the two elements and provides a single point of management for these functions within the Directorate. In so doing, environmental protection, base master planning and development, and comprehensive land use planning will be managed as a fully integrated effort. The staff is multidisciplinary and includes experienced, fully qualified urban planners. This new capability is essential in carrying out a comprehensive planning program.

In conjunction with the realignment, the Directorate mission statement was also revised to include responsibility for comprehensive planning. This addition to the mission statement reads as follows: "Formulates policies and implementing techniques and develops the broad base of managerial plans, procedures and informational material necessary to the successful conduct of USAF-wide programs for comprehensive, land use planning and compatibility (both on and off-base), improved utilization and management of existing facility assets/resources, and installation rehabilitation."

How the Directorate of Civil Engineering is now organized is shown on the chart below. CE



* New Division ** New Branches

New SAC Civil Engineer Stresses Management, People

After your first meeting with the new Deputy Chief of Staff for Civil Engineering at Headquarters Strategic Air Command (SAC), you depart confident that your first impressions will certainly be lasting ones. Tall, boyish-looking Brig Gen Stuart H. Sherman, Jr, is an impressive officer—in many ways.

First, he has the military background: a graduate of the US Naval Academy, Class of '53, and an officer whose 21 years in the Air Force are dotted with progressively more responsible positions which are a testament to his dedication in accepting any challenge assigned to him.

Second, he has extensive experience with strategic weapons systems throughout SAC. Briefly, he served with the SAC B-52/KC-135 Operational Engineering Program at Castle AFB, California; worked on the Atlas, Titan and Minuteman ICBM systems at Headquarters SAC, Offutt AFB, Nebraska; served as the Director of Programs for the 4000th Support Group at Offutt AFB; and established the Astronautic Technology and Applications Office for the Directorate of Plans, Headquarters SAC.

Third, he has the Headquarters US Air Force experience: he served as a staff member for the Deputy Chief of Staff for Research and Development in one three-year assignment, followed by a two-year tour as Executive Assistant to the Under Secretary of the Air Force, John L.McLucas (now the Secretary of the Air Force).

Finally, he has the educational background: a master's degree in both astronautical and instrumentation engineering from the University of Michigan, as well as professional military education from the Armed Forces Staff College and the National War College.

This background coupled with the experience he received during his immediate past two assignments as the Vice Commander of the 91st Strategic Missile Wing at Minot AFB, North Dakota, and as Commander of the 321st Strategic Missile Wing at Grand Forks AFB, North Dakota, reveals what perhaps may be the most obvious of his personal traits, that is, the importance he places on effective management and his concern for people.

Puts them together impressively . . .

What provided this insight was the spontaneous response he gave to the remark that he now occupies a position that many consider as one of the most demanding in civil engineering. "I accepted this responsibility as a vote of confidence," he said. "Since I have become more a manager than a practicing engineer in the true sense of the word, that fact alone should prove of especial benefit to the civil engineering community. I will be looked upon by the people who have grown with civil engineering over the years to provide the leadership and guidance necessary for the effective and responsive management of resources. We will accomplish this together."

Appointed to his new position in only February of this year, General Sherman has assessed his responsibilities and has set stringent goals for himself. If past achievement is any gage, then there is little doubt but that he will succeed.

"I intend to continue the important procedure of the daily stand-up briefing since we need to know what is going on at the base level. I do not intend to change the operational procedures of civil engineering but want to provide some change in thoughts. Most important is the building of a more personal relationship between the bases and base and wing commanders so as to respond to their problems. I intend to build a reputation within the Command for a better understanding between the people in the field, the commanders and the Commander-in-Chief of SAC. Through staff assistance visits, we will find out how the job can be done better and then provide the necessary assistance to get it done effectively and efficiently. And I want to help the BCE in those situations that may appear beyond his control; we will help him instead of inspect him."

Drawing from his experience as a Wing Commander, he candidly related: "I advocated three attributes from my people. One is personal integrity. Unless you know yourself, you'll never make it. Two, there are rules that govern us. They are there to help; abide by them. And finally, your job is your responsibility. Know it and get it done to the very best of your ability."

Management and people—General Sherman has an impressive way of putting them together. CE

BEAMS is a system which should be a realistic model of the functioning of the Base Civil Engineering organization. The question is: does this system help in identifying problems? Four examples from SAC bases prove

BEAMS Gets the Job Done!

by Capt Donald H. Limberg

BEAMS stinks! BEAMS is the greatest! BEAMS is beautiful! BEAMS is a mess! These are but a few of the variety of exclamations heard about the Base Engineer Automated Management System (BEAMS). This system should be a realistic model of the functioning of the Base Civil Engineering organization and should portray the capability of the organization to accomplish its assigned mission. However, a serious lack of understanding exists concerning the data contained in the total system and of the information contained in the various BEAMS products. Middle management personnel within civil engineering have been reluctant to become sufficiently familiar with the system and its products to make effective use of the listings in managing their activities. Even though industrial engineering sections at base level have provided the impetus through numerous briefings to appropriate supervisory personnel, still, much needs to be done.

In discussing BEAMS, the range of effort could start with the computer and proceed from the inputs via the remote device to the output products. However, the results of this system should provide needed information when required and, in addition, should be accurate. The real question is: Does this automated model help civil engineering in identifying problems? In an effort to get down-to-earth-answers to this question, four bases were asked to provide comments.

The Executive Management Summaries (EMS) are most helpful in detecting existing problems and those that may arise in months to come. One of the five EMS products is the work control EMS, which shows the backlog of shop months for maintenance, repair and minor construction work, the number of work orders in work stoppage, number of work orders which have exceeded 100 percent of the approved cost, and number of work orders and approved hours presently in the system. These data indicate to the Base Civil Engineer and his staff the areas in which problems may exist.

1 At Offutt AFB, Nebraska, an analyst in Industrial Engineering, illustrates the identification of a problem and subsequent follow-up action. "The work control EMS indicated four contractual work orders which had exceeded the original cost estimates. A Base Level Inquiry was developed which keyed on Work Order - Indicator 'C' for contracts requesting all such work orders that showed total costs exceeding estimated costs. This listing was subsequently used to compare the project folders to the BEAMS data files. Two of the work orders were in error due to remote input errors made when loading the work orders into BEAMS. The Work Authorization Specialist subsequently corrected these errors. One of the four work orders had an approved project change, but no change order had been prepared to the work order to reflect the increased project costs. The fourth work order was 100 percent complete and revealed a two percent overrun. Thus, this one entry in the Work Control EMS helped identify several problems which were corrected. Subsequently, a procedure has been developed to limit the possibility of their repetition."

2 An Industrial Engineer at Dyess AFB, Texas, comments about another EMS report—The Total Programming Executive Management Summary. "The Total Programming Executive Management Summary is valuable for use in indicating whether or not an imbalance in manning may exist in the various operations and maintenance work centers, requirements for additional contractual support, or how well the annual work plan is being followed. Prior to BEAMS it was difficult to determine just how much of the total work load would be accomplished by in-service forces and how much would be accomplished by contract. The Total Programming EMS provides a management tool to point out problem areas in annual work plan accomplish-

ment. For example, a full 12 month work load for the Pavements Shop was included in the annual work plan at the beginning of the current fiscal year. At the end of four months, the Total Programming EMS indicated that there were still 11.5 months of work to be accomplished. An investigation revealed that previously unknown but now urgent work requirements had been accomplished, thereby leaving the annual work plan work requirements unaccomplished. Therefore, a decision was required to either accomplish the 3.5 months of work by contract or defer it for future year accomplishment."

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3 One of the several daily "exception" type reports is the Cost Limitation Comparison Report, PCN N200366. It provides an indication of in-service type work orders in which total actual costs have surpassed total estimated costs. An Industrial Engineering Analyst at Vandenberg AFB, California, comments, "Our Cost Limitation Comparison Report (PCN: N200366) is used as a management tool to identify problem areas involving work orders. Since this is a daily product, we have one individual who researches each work order on the list to determine what action is necessary to remove it from the report. For example, if he determines that a change order is necessary, he follows through on a daily basis until the change order is completely processed and the appropriate entries are made to BEAMS. If he finds that the materials cost more than what was anticipated, he discusses the problem with the planner and/or shop foreman to insure the proper materials were received, then updates the estimate in BEAMS. The emphasis is on finding the cause of the problem and correcting it as opposed to making a "paper work" transaction into BEAMS solely for the purpose of removing the work order from the product."

The Base Level Inquiry System (BLIS) is useful in identifying in-house problem areas. The data available through BLIS may provide concise, yet detailed information in the desired format. Examples in the use of BLIS are many, and if used discriminately, the time saved through use of these inquiries is well worth the effort and computer time involved. The analyst at Dyess AFB further comments, "A BLIS report which has been extremely helpful at Dyess AFB has been one that identifies work orders for which materials have been available over 180 days but the work has not yet started."

The analyst at Vandenberg AFB adds, "At our base, the Work Authorization Specialist (WAS) requests a BLIS inquiry monthly to obtain a listing of work orders listed by facility. As new work requests are received, the WAS refers to the BLIS to determine whether the request is a duplication of another work order. This saves time and eliminates duplication."

These types of inquiries are two examples of some 83 inquiries developed by Strategic Air Command (SAC) bases and are included in a library booklet prepared by SAC Headquarters, a copy of which has been forwarded to each major air command. Some inquiries included in this booklet have been designed to help monitor the accuracy of SAC inputs to the system.

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4 For example, an Industrial Engineer who was recently reassigned from F E Warren AFB, Wyoming, to Hahn AB, Germany, comments, "Use of BLIS requests to monitor the processing of material transactions can often lead to unexpected results. Several months ago at F E Warren AFB, routine requests were processed against the Transaction History File (THF) and the BEAMS end-of-month AATP2T (Material Interface File for Accounting and Finance). Although material transactions listed on each report should have been identical, examination revealed that approximately $27,000 in material costs were not found in the AATP2T file. Immediate investigation revealed that an unexpected hardware malfunction resulted in the random deletion of several hundred material records. Many headaches and hours of research were eliminated. Recovery was easily accomplished by reexecution of the responsible program."

The above comments are provided as examples from SAC bases of just a few of the many ways the standard reports and BLIS inquiries can assist in identifying difficulties and help civil engineering improve its work. Many more examples could be cited but the intent is to indicate that the use of BEAMS and BLIS is only limited to one's imagination.

Many more bases are making worthwhile use and sound decisions from the information in the automated system. However, some bases still complain that the data are just a lot of garbage—with little meaning. The latter statement may be accurate for those bases; however, it is obvious they lack knowledge of the system. The manager who makes such a statement has identified a definite problem which may be attributable, for example, to incorrect input and/or inadequate training. The point is that the system has told the managers something. The Management Review Committee should task the Industrial Engineer to study this area and make recommendations for eliminating the "garbage." The automated system should be a model of reality and reflect true facts. If, however, it does not reflect reality, problems of management and control may be far greater than suspected. CE

CAPTAIN LIMBERG *is currently assigned to the 3772 Instructor Squadron, Sheppard AFB, Texas. Previously, he was a Data Automation Officer, Civil Engineering, Headquarters Strategic Air Command, Offutt AFB, Nebraska. He has been affiliated with civil engineering for the past four years and took part in the implementation conversion of many Strategic Air Command bases to BEAMS. He received his bachelor's degree in business administration from Colorado State University.*

The Air Force is responsible for nine million acres of land. Air Force managers occupy a unique position in the renewable natural resource management area. An example of Air Force leadership is a program underway at Eglin AFB, Florida where the base and the Boy Scouts of America have jointly entered in a forest management program. It's also an example of . . .

Growing Together

by Lt Col Paul L. Gray

Have you tried to buy a Sunday newspaper at your newsstand lately? In many parts of the nation, the supply of newspapers has been reduced drastically because of the shortage in pulpwood for newsprint. Grocery store managers, because they can't get enough paper bags to meet their needs, have requested their customers to bring their own paper bags. Have you bought a 2 x 4 lately? The price may have doubled since your last purchase, an indication of strong demand and **short supply.**

How often in recent years have you gone hunting and even seen a deer, to say nothing of bagging one? Where can you find fishing good enough to provide a fish dinner for your family? Do you still know many places where you can camp in privacy, or hike without stepping over trash or view scenery without smog?

This is the natural resource picture today. Wood is in short enough supply to drive prices up. It takes a minimum of 15 to 20 years to grow pulpwood and a minimum of 50 to 80 years to grow sawtimber for lum-

ber and building supplies. Our land use patterns are definitely pointed toward developing land areas to residential and business uses and decreasing land areas available for forest, wildlife and outdoor recreation. Thus, areas available for renewable natural resource growth are decreasing at an increasing rate and there is no indication that the situation will naturally correct itself. The solution is up to today's managers and directors to develop more intensive long range land use planning.

Air Force managers occupy a unique position in the renewable natural resource management picture. Within the Department of Defense (DOD), nearly 26 million acres of public land are being used for national defense purposes, the Air Force having responsibility for about nine million acres. Natural resource programs may be instituted at each installation under the guidance of DOD Directive 5500.5, as amended, "Natural Resources - Conservation and Management," and **AFM 126-1,** "Conservation and Management of Natural Resources." Some bases do have natural resource programs which include forestry, fish and wildlife, outdoor recreation and agricultural outleasing. Air Force natural resource programs must be compatible with the primary mission of national defense. In most instances proper management of public lands will allow concurrent and multiple use to produce sustained yields of renewable natural resources.

The Air Force implemented the first service-wide conservation program at selected reservations in 1949. Progress was slow during the 1950s. By the 1960s, the general public became concerned about the environment and the result was enactment of the National Environmental Policy Act (Public Law 91-190). Governmental emphasis increased when the President, in his February 1965 message to Congress, noted concern for environmental quality and the adequacy of natural resources to meet future demands. Shortly thereafter, all Federal agencies were directed to intensify conservation measures on lands under their control. The DOD responded by revising its natural resources directive (DOD-D-5500.5), requiring all military departments to implement active, progressive, continuing programs for the conservation and management of natural resources under the principle of mulitple use-sustained yield as defined in the Multiple-Use Sustained-Yield Act (Public Law 86-517). Under this definition, public land use must be **planned** and **coordinated** to achieve a pre-determined **objective.**

Manual Makes Provisions

Policy and procedures relative to the National Resources Program were developed in **AFM 126-1.** This manual provided for the following:

- Assignment of program responsibility to civil engineering.
- Establishment of land use priorities.
- Requirement to revise existing fish/wildlife cooperative agreements.
- Requirement to separate fish/wildlife plans from the cooperative agreement, and
- Requirement for an Outdoor Recreation Plan.

About eight of the nine million acres of land for which the Air Force has responsibility, are in unimproved grounds. These acres have natural resource use implications and are thus the work area for the Air Force natural resource program. Eighty Air Force bases covering six million acres in the zone of interior presently have some type of natural resource program. Further insight can be gained by examination of the primary functions.

Primary Functions Listed

FOREST MANAGEMENT: Program authority is contained in annual DOD Appropriation Act, DOD-I's 7310.1 and 4170.7, and **AFM 126-1.** The program was implemented in 1961 and has been funded from the proceeds obtained from timber sales. Activities which fall within the reimbursable scope are forest sales, timber stand improvement, reforestation, forest production and construction/maintenance of timber access roads and trails. Presently 30 installations are participating and 750,000 acres have been classified and inventoried. The saleable timber is currently appraised at $45 million and should increase to $75 million by 1980. **The most pressing problem in forest management is reforestation, with over half the forest land in need of regeneration.** Much work needs to be done to improve this function.

FISH AND WILDLIFE: This function is governed by Public Laws 81-345, 86-797, 85-337, 85-624, 89-669, 90-465, DOD-I 4170.6 and **AFM 126-1.** In substance, these directives specify a fish and wildlife conservation program for all military installations. In most cases, individual states regulate the fish and wildlife populations, except for migratory birds, and the Air Force is responsible for migratory bird habitat. A nominal user fee is authorized with the proceeds used exclusively to sustain the program at each installation.

The Endangered Species Acts of 1969 (PL 89-669) and 1973 (PL 93-205) direct the protection of species of native fish and wildlife, including migratory birds, that are threatened with extinction, and the conservation of the habitat of these endangered and threatened species. Many endangered species inhabit land and water areas under Air Force control. An example of a project of this type was the establishment of the 394,000 acre wild horse range at Nellis AFB, Nevada.

Currently, 45 installations are classified as having suitable habitat for fish and wildlife purposes; however, not all have been able to participate. Approximately six million acres of land, 400 miles of streams and 12,000 acres of ponds and lakes are under various degrees of management. Again, an expanded resource management program is possible.

OUTDOOR RECREATION: The basic program authorities are Public Laws 88-29, 90-465, Executive Orders 11593 and 11644 and **AFM 126-1.** In the past, outdoor recreational use on Air Force controlled lands

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Growing Together *cont'd*

was primarily an unplanned by-product of other activities. Nevertheless, almost three million visitor days per year have been recorded on Air Force lands. The national demand for outdoor recreation is projected to quadruple by the year 2000, while the resource base will continue to dwindle.

The above legislation stipulates that all levels of government should take prompt and coordinated action to the extent practical without diminishing or affecting their respective powers and functions to conserve, develop and utilize these resources for the benefit and enjoyment of the American people. Implementation of cooperative programs is authorized between the installation, the state, and the Department of Interior, with all functioning through the Bureau of Outdoor Recreation. The Federal government is to provide leadership in preserving, restoring and maintaining the historic and cultural environment of the nation. Many such features are located on Air Force installations.

To promote the establishment of a common framework for effective management of outdoor recreation resources, the Air Force has modified and adopted the uniform system of recreation resource classification as proposed by the Outdoor Recreation Resource Review Committee in its 1962 report. Under this system special interest features are identified and suitable land and water areas are zoned for specific recreational activities. Special interest features include sites of archaeological, geological, historic, scenic, botanical and biological importance. Measures are being taken to identify, preserve and protect these areas, and for their inclusion in the National Register or designated as Research Natural Areas, as applicable.

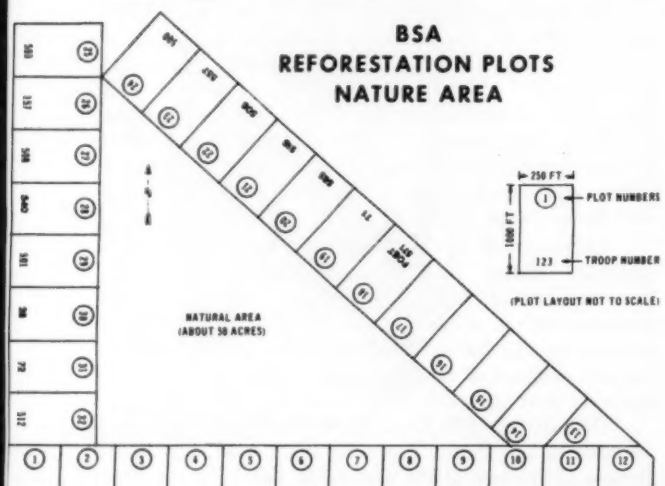
The recent requirement to develop formal Outdoor Recreation Plans will highlight the special interest features, existing resource supply, demand and potential development, and will provide recommended carrying capacities for specific uses. This relatively new program will have great impact on future land use and is one of the prime areas in need of professional resource skills. The effective conservation and use of recreation resources must be based on the best knowledge and skills available if we are to properly meet future demands.

RANGE MANAGEMENT: The authority for grazing and agricultural outleasing rests in Title 10, USC 2667. In January 1974, 185,000 acres were outleased for grazing and about 31,000 for agricultural purposes. About 85 agricultural and 35 grazing outleases were in effect. Proceeds of $320,000 annually have been deposited in the Treasury as miscellaneous receipts. However, this figure is not indicative of total values received because outleases include maintenance performed by the lessees. Range management involves the practical utilization of vital natural resources that calls for professional management and technical guidance to assure a proper place in a multiple use sustained yield program.

Thus it is obvious that progress is being made to enhance the renewable natural resource base and that the Air Force has the basics necessary to more fully develop its assets.

In the discussions of future natural resource programs, an example of Air Force leadership is unfolding at Eglin AFB, Florida. Under the auspices of the Directorate of Civil Engineering in the Armament and Development Test Center (ADTC), a joint Air Force-Boy Scouts of America project has been initiated that could well become a model program throughout the Air Force and other military services that serve as trustees of public land.

Figure 1: Eglin AFB Reforestation Layout.



Working Agreement Made in 1973

In November 1973, a Working Agreement was made between ADTC, Eglin AFB and the Choctawhatchee District, Gulf Coast Council, Boy Scouts of America, to enter into a reforestation program on a selected area of the reservation. Many acres of the forest land are understocked and are below normal timber production capacities. Most areas have plenty of trees but the pine species which form the saleable product types are most often crowded out by scrub oak, bushes, palmetto, etc. Thus stocking here is an index of the number of pine per unit area.

The Natural Resources Division at ADTC began a 10 year forest management program. Areas which could be utilized for the primary mission and for forestry, were divided in plots of around 800 acres called record units. In each unit, prescriptions for planting, improving and harvesting were performed on a sched-

uled basis. But the large areas associated with armament testing and also available for forestry require a great deal of time, labor and money to make improvements. Although great strides have been made to increase productivity of this land, much work remains to be done. However, the effort is worthwhile because a potential threefold increase in productivity is possible when the understocked land is improved. There is need to enhance these natural resource areas through clearing, planting and improving the basic land resource to provide timber product inputs to our nation and economy.

In essence, the Working Agreement centered around identifying some 200 acres of this poorly stocked land in an area that was compatible with the primary mission, and where clearing and planting would bring the greatest returns.

The reforestation layout is shown in **Figure 1.** The triangular area is circumscribed by a sand road permitting access to each plot. A boundary line was plowed around each five acre plot and assignments were made. Each Boy Scout troop was obligated to make a plan, clear the plot and plant. Beyond these requirements each group was free to select hardwood species to leave or cut, cut all or part during the first year, select the species to plant (longleaf, slash or sand pine), plant wildlife food plots, leave den/nest trees for birds and game, etc.

Primary Purpose is Reforestation

The primary purpose of the project is reforestation by clearing and planting; however, the area may well be used for wildlife projects such as brush pile game havens, den tree preservation and game food planting. Outdoor recreation opportunities exist through hiking, swimming, nature trails, hunting and nature study.

An area nearby was designated an overnight camping area, affording the Scouts the opportunity to be near their work. Space is also available for each Troop to camp immediately across the road from its reforestation plot. The inner triangle in **Figure 1** was designated a natural area for use by all the groups and to be left in its natural or primitive state.

Plot One is labeled the "control plot" and is being developed as a model or demonstration area. On the control plot, each Troop will be able to view a completed reforestation unit with recommended clearing and planting techniques. Each Troop may then follow the demonstrated pattern and add its own variations.

The Eglin Natural Resources Division is providing direction in approved forestry methods and techniques, supplying seedlings or seed for planting, passing on each Troop forestry plan and making an annual survey of the plots to select and present awards to the Troops that have made the most progress in reforestation each year.

Scoutmasters are asked to guide their Scouts in clearing hardwoods and brush, piling brush and slash in wildlife haven brush piles, planting, providing tree thinning and pruning, and caretaker operations as needed. Since each tract will "belong" to a Scout Troop as long as it is properly tended, the project serves as a visible long term contribution of the Boy Scouts in the improvement of the diminishing natural resources of the nation.

COLONEL GRAY *worked as a Special Assistant for Natural Resources, Civil Engineering Directorate, Eglin AFB, Florida during the past two years. A command pilot, he earned his bachelor's degree in military science from Oklahoma State University, his master's degree from the University of Michigan and is currently doing graduate work in forestry at Auburn University.*

The potential value to the nation of this effort is interesting to note. In the Southeast, it takes 60 years to grow sawtimber for lumber. In a best case example, using data from the best site class in a Southeastern forest with below average soil, a well tended acre can produce 17 cords of pulpwood as well as 22,000 board feet of lumber in 60 years. Cordwood is currently selling for $30 per cord and sawtimber for $165 per thousand board feet. Thus, the return of almost $70 per acre per year through timber sales is possible under a program such as this. At $70 per acre per year, 150 acres represent a possible income of $10,500 per year of $630,000 worth of pulpwood and timber for lumber over a rotation of 60 years.

Further, it is interesting to consider the 50 Air Force bases with forestry potential. If these bases initiated reforestation projects, averaging only 100 acres each, 5,000 additional acres could be added to the forest production program. This represents a possible annual income of $350,000 or $21 million worth of timber products over a rotation period of 60 years.

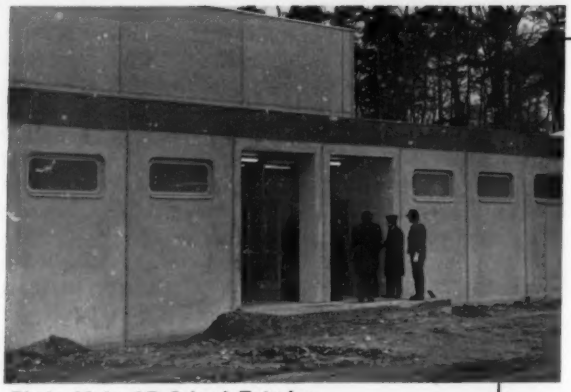
There are some 200,000 Boy Scout troops in the United States. If only 1,000 troups or about 0.5 percent of these Scouts joined with the Air Force to reforest five acres each, a 5,000 acre program would be very practical.

The amount of possible return to the Federal treasury soon reaches sizeable numbers. Thus far, no attempt has been made to measure the benefits of directed purposeful effort to the young people involved, nor the input of these wood resources in our economy. Equally important, is the building of rapport and permanance in community relations and local pride.

More than ever before, the Air Force is becoming concerned with the effective use of the land and water areas under its control. It has an unequaled opportunity to fully utilize natural resource capabilities in forestry, fish and wildlife and outdoor recreation on portions of the public lands held in trust. New legislation and new personnel skills can be of significant benefit. In the interim, community and civic action programs such as joint reforestation efforts with the Boy Scouts of America provide dollar as well as character values of intrinsic worth to the Air Force and the nation. A splendid opportunity—growing together! CE

Headquarters USAFE Civil Engineering has proved that modular construction can be a viable alternative to conventional construction. It has provided a first class educational environment which is certain to enhance the process of education within the Air Force.

USAFE Schools Go



Rhein Main AB School Exterior.

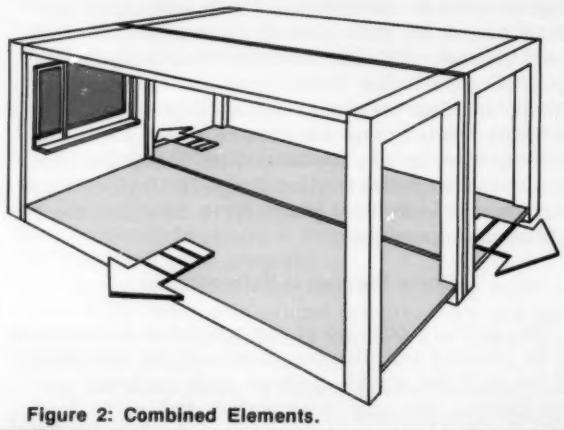


Figure 2: Combined Elements.

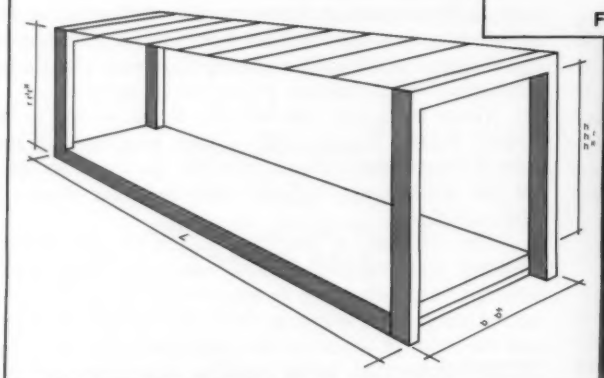


Figure 1: Basic Variel Element.

Another Exterior View of Rhein Main School.

MOD-ular

by Capt Gary B. Willems

■ Several major organizational relocations occurred within Headquarters United States Air Forces in Europe (USAFE) during FY 1974 which resulted in a concentration of base populations and an associated adjustment in student enrollment. Simultaneously, emphasis was being increased on the "people" aspect in

planning and construction of community facilities.

A review of existing school facilities revealed the need for a new approach to school planning. In the past, conventional methods were employed in school construction and the traditional approach was used in their design, with inadequate thought given to providing a pleasant environment. Coupled with this was the cumbersome process of Military Construction Program (MCP) acquisition. Unlike stateside construction programs, the contracting procedure in Europe is further delayed by the Status of Forces Agreement which includes the Host Nation. For an MCP project of magnitude, this process historically consumes

- An average of 400 days for planning and design.
- 120 days for solicitation and contract award, and
- A minimum of 18 months for construction.

At the time school construction was being planned, the purchasing power of the dollar in Europe was decreasing and indications were that it would continue to decline. In addition, the inflation rate in Europe was climbing approximately one and a half percent per month for materials and labor. These problems, plus the immediate need for schools, made it obvious that drastic steps were necessary to compress this cycle and minimize the adverse monetary trends. An investigation into modular construction was initiated. The objective was rapid construction of high quality facilities within cost limitations, comparable to conventional construction.

Projects programmed and approved in the FY 1973 MCP package included schools located at Rhein Main AB and Ramstein AB, Germany, and Soesterberg AB, The Netherlands, **Table 1.** The construction industry in Europe and in the US was canvassed to determine if building systems existed which met the nonrelated and, at times, conflicting requirements of rapid erection, competitive costs, high quality finish, structural adequacy and relocatability. It was concluded that modular construction could realistically meet these goals.

Table 1: USAFE School Program.

LOCATION	SCOPE (SF)	TYPE CONSTRUCTION	CONSTR PERIOD (MONTHS)
Rhein Main, Germany	77,200	Variel Modules	6
Soesterberg, Netherlands	14,000	Variel Modules	6
Ramstein, Germany	97,900	BN-System BAU Modular	9
Aviano, Italy	30,000	Conventional	12
Sembach, Germany	28,400	Modular	* 7, 9 or 12
Bitburg, Germany	85,690	Modular	* 7, 9 or 12
Hahn, Germany	44,986	Modular	* 7, 9 or 12
Upper Heyford, England	60,000	Modular	12

* Variable depending on bids.

Modular construction is competitive because the rough as well as finish construction of buildings can be accomplished in a factory with the advantages of assembly line techniques, employment of unskilled labor, multiple shift operation, quality control and independence from weather. The US versus European systems were analyzed. It was determined that US modular relocatable facilities would not meet the requirements as well as the European systems. This conclusion was based on a unit price cost comparison, primarily due to the high cost and time required for transportation. This basic decision set the wheels in motion for the contracting of modular schools through the European design/construction agencies.

The next step in the acquisition process was to determine how the requirements for a dependent school would culminate in both a functional and modern facility. Expediency dictated that the standard design process be substituted with a design/contruct systems engineering contract, but caution and established procedures opted for the full design before contract award approach. The obvious advantage of a design/construct package is that it optimizes time; additionally, the contractor can tailor the design to take advantage of special features of his product. The primary disadvantage of this approach is the risk involved when construction and design occur simultaneously.

After weighing all considerations, time was determined as the most important factor, so the systems engineering concept was approved. The management and execution of this large program was vested in the USAFE Deputy Chief of Staff for Engineering and Services, Directorate of Construction. A special Schools Team was appointed to manage the total program, and it was assisted by the US Army Engineers, Headquarters US Dependent Schools European Area (USDESEA), school faculties, Base Civil Engineers, and officials of the Host Nation government.

To begin the process, an educational specification was prepared by USDESEA. The document outlined the basic requirements to meet accreditation and educational criteria. These requirements were then translated into concept drawings which were combined with an outline and a quality specification to complete the bid package. The invitation for proposals was initiated and the contract awarded by the Host Nation government. Subsequent to contract award, the contractor immediately started the detailed design, and shortly thereafter, ground was broken for the foundations.

Of the systems analyzed, two different approaches emerged when contracts were awarded for the first three schools. The schools at Rhein Main AB and Soesterberg AB utilized the Variel concept whereas the system used for the Ramstein AB school is a hybird called BN-System Bau. The Variel elements consist of a three dimensional open cell unit, comprised of two reinforced concrete portal frames rigidly joined to each end of a prestressed ribbed concrete floor panel, **Figure 1.** These room elements are not restricted by bearing walls on their perimeters; they are open on all four sides with the vertical loads

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mod-ular *cont'd*

being borne by the four corner columns. The elements can, therefore, be combined in all directions and orientations and offer infinite variations and floor plans, **Figure 2.** Since there are no bearing walls, the interior configuration including partitions, stairwells, sanitary fixtures, etc., can be arranged or rearranged as required. In addition, the exterior cladding selection is unlimited. The elements can be completely finished at the factory to include installation of windows, heating elements, electrical conduits and outlets, plumbing installations, and wall and floor coverings. When the modules are put in place, utility services are connected between modules to complete each system.

The Rhein Main AB school complex, the first completed in the program, is comprised of four separate elements which total 77,157 square feet: a two story junior high wing, a two story elementary wing, a multi-purpose gymnasium, and an instructional material center/library. Special features provide the latest in educational innovations and equipment and the best quality in furnishings. Today the trend in education is toward modernized educational techniques. The techniques include multiple use rooms; increased use of audio-visual aids which allow for large group or individual viewing of films, slides and television; use of tape recorders and other listening devices; and the use of programmed materials. Because greater quantities of material and a higher use of teaching aids is emphasized, the design is focused on an instructional materials center integrated into a library which not only houses books, but the majority of equipment and multi-media training aids to be utilized under this concept.

Since the school was erected in close proximity to the flight path of the Frankfurt Airport, it necessitated the maximum possible in sound insulation. This was provided by the installation of carpets, acoustical tile, double windows and ceiling insulation. Another feature is a combined air/hot water heating system which can provide up to 10 fresh air changes per hour. Windows, heating elements, plumbing, electrical wiring and outlets were factory installed.

Special emphasis was placed on interior decorating. An architect assigned to the USAFE Civil Engineering Division selected fixtures, materials and color schemes. All general purpose classrooms have patterned carpet which minimizes visible dirt and damage marks, and serves as an aid to the acoustic qualities of each room. Three color combinations were selected for classrooms; each room was painted in at least two colors and finished with wood baseboards. Ceilings have acoustic tile with flush mounted fluorescent lights. Toilet areas have color coordinated floor tiles and ceramic wall tiles.

A 63 by 55 foot room in both the elementary and junior high wings can accomodate the cooperative team technique of instruction whereby two or more teachers work together. Each room is equipped with folding, acoustically insulated partitions which can be opened or closed to provide any combination of up to four separate classrooms. Classrooms have multiple electrical outlets, venetian blinds and wardrobes. Two teachers rooms are provided for each of the cluster arranged rooms. All rooms have a built-in two-way public address system.

The gymnasium is designed as a multi-purpose facility with provisions for gymnastics, basketball, volleyball, badminton and physical education classes. Showers and dressing rooms are equipped with quality fixtures, metal lockers, and special moisture-proof acoustic ceiling tile. Also, a stage is located at one end of the gym, and is equipped with curtains, lights, dressing rooms at each side, and a large storage area for chairs below the stage.

Exterior finishes were also given special emphasis. External walls are a combination of dark and light brown exposed aggregate and smooth concrete panels. Aggregate panels are arranged to highlight the smooth concrete panels which house aluminum frame windows with rounded corners. At all times consideration was given to long life and low maintenance. The exterior treatment did not terminate at the one meter line. Consideration was also given to student traffic flow and recreational areas. Plans include an outdoor multi-purpose court for tennis, badminton and volleyball, a soccer/football field, and track facilities.

Library at Rhein Main AB School.

This description of the Rhein Main AB school could easily be applied to any well planned and designed facility. The significant difference between this project and any other is that the contractor was notified to proceed on 7 June 1973 and, only 180 days later, on 12 December 1973, the grand opening ceremonies were held!

The hybrid system utilized in the construction of the Ramstein school differs from the Variel elements in that precast reinforced concrete structural members are used throughout. The stripfootings and first floor were poured on grade. The stripfootings were underlain with lean concrete to solid sandstone. The precast load

bearing wall panels rest directly on the stripfootings and support interlocking precast double-tee floor and roof panels. For the combination classroom areas which require a large clear span, precast columns and composite structural steel/concrete beams were used. The precast concrete members were fabricated in a plant six miles from the base. The elements were transported to the site by flatbed trucks and erected at a rate of 18-20 members per day. The erection commenced with the wall members being placed and temporarily braced while the interlocking double-tee roof sections were lowered in place. Adjacent panels and corner sections were secured by recessed steel plates and bolts.

All wall and floor members on one level were installed and secured prior to start of the next level. The roof was completed and sealed, dry wall partitions installed, and interior precast walls finished with a sprayed on plaster. The remaining interior work followed conventional construction methods.

The Ramstein AB school complex comprises two separate elementary classroom buildings and an addition to the existing school, for a total scope of 97,900 square feet. The two elementary school buildings are of three story construction; one houses the large instructional material center, while the other includes the multi-purpose room. The multi-purpose room was designed to accommodate several different functions including large group instruction, student assembly and noon food service. A cafeteria is located adjacent to the room and will serve 600 to 800 students per day. Used as an auditorium/assembly hall, such activities as concerts and plays can be held in the room. Dressing rooms, special lighting, stage and backdrop curtains, and acoustical treatments are included for this function.

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The addition to the existing school is a two story building housing junior high school activities such as music, industrial arts, home economics, general shop and business education.

As a result of the increased demand on the base heating plant, provisions were made to include a heating plant specifically for the new school.

The architectural features, interior decor and functional layout of this school are identical to those provided at Rhein Main AB. The added bonus was that changes could be implemented as a result of lessons learned on the first project. The exterior treatment differs from the Rhein Main AB school in that tone down colors were required. Therefore, a smooth concrete finish was specified for the majority of the facility, with accent panels provided with a textured grain finish. An added exterior feature was the use of open patterned paving stones with grassed geometric voids in the courtyard area surrounding both buildings. Exterior plans also included facilities for sports and other recreational activities, as at Rhein Main AB. In contracting for this project, consideration was given to the fact that the facility was much larger than the Rhein Main AB school, and the contract period was specified as 270 days.

The preliminary actions for contracting the Ramstein AB school occurred simultaneously with the Rhein Main AB project. There was one exception that called for preparation of a single bid package for site work and the facility, with an additive alternate proposal to include a heating plant. The same outstanding performance and cooperation of all personnel in the contracting process resulted in the contractor being notified to proceed on 10 June 1973, with a scheduled contract completion date of 15 March 1974.

The design review and material selection followed the procedures established at Rhein Main AB. Fabrication of the concrete members was slightly delayed while preliminary electrical and mechanical designs were prepared and approved so that provisions could be made for conduits and ducts. Foundations and site work were initiated shortly after contract award. The interior work commenced prior to the onset of cold weather, thus allowing work to continue on schedule. Again, a well organized and managed construction program resulted in meeting the challenge of a completed facility in nine months. The handover of the school took place on 5 April 1974.

The Soesterberg elementary school was also constructed using the Variel modules. This 14,000 square foot facility was an addition to an existing school and has general purpose classrooms, arts and crafts room, a 3,000 square foot multi-purpose room and administrative rooms. The overall description of finish and architectural features for the Rhein Main AB school were applied to the Soesterberg AB school, but on a smaller scale. The Variel modules used in the application differed in that the portal frames were of galvanized steel. Exterior walls, internal partitions, plumbing and fixtures, electrical installations, and the interior vinyl wall finishes were all fitted at the factory. Contracting procedures were similar to those utilized in Germany. The performance specification included site work, the school building, a parking lot and access road, and landscaping. The higher degree of factory finish and smaller scope resulted in completion of this school in only five months.

Three of the eight MCP programmed schools for FY 1973 and 1974 have been completed. It is time to reflect. Was it worth all the effort? Is the finished product comparable to other methods? What factors are important when considering modular systems? As pre-

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mod-ular *cont'd*

viously stated, the finished projects are the culmination of the efforts of many organizations and individuals. Some lessons were learned by the first efforts which will be applied to follow-on projects. It is essential that adequate planning and design review be effected prior to work start.

In the projects described here concrete was being poured concurrent with design. Some mistakes were inevitable; however, they were minor and were corrected. Another pitfall is a separate bid package and contract for any portion of the work. If a large contractor successfully bids a project, the coordination and subcontracting of all other portions of the project can be better controlled by a prime contractor. When possible, maximum use should be made of locally procured materials since purchase from US manufacturers does not normally afford expeditious delivery, if the job is being done overseas. The quality of finish is excellent and it is not obvious that these are modular facilities. There is no doubt that the end product equals or exceeds conventional methods.

It has been demonstrated that, given proper emphasis and latitude, innovations can be incorporated in the MCP. The fact that all three schools were completed in record time proves that modular construction provides a viable alternative to conventional construction. The importance placed on high quality materials and finish has resulted in a first class educational environment which will certainly enhance the process of education. Not only are these completed projects a tribute to the ingenuity of engineers, but they also open new horizons for the consideration of modular systems for other applications. Certainly, USAFE will benefit from continued emphasis on modular facilities, as proposals are now being prepared for the construction of modular "Instant Schools" at Hahn AB, Sembach AB, and Bitburg AB in Germany as well as at RAF Upper Heyford in England. CE

Kindergarten Room at Soesterberg AB

13 AFCEs Selected to Attend Senior Schools; Record May Have Been Set

In what might be described as an unprecedented occurrence, 13 Air Force Civil Engineers (AFCEs) were named to attend various senior military schools in the coming year, it was announced recently by Headquarters US Air Force. Although past statistics are not available for comparative purposes, it is believed that the naming of the 13 AFCEs is the highest number ever selected in Air Force Civil Engineering history. All selectees are Lieutenant Colonels.

Nominated to attend the Air War College are Earl S. Doderer; George F. Francis; Stewart W. Johnson; Norwood J. King; Leo E. Sheehan, Jr; Sven E. Sloth; and Alan J. Williams.

Chosen to attend the National War College are Jarrell S. Mitchell and Ellie G. Shuler, Jr.

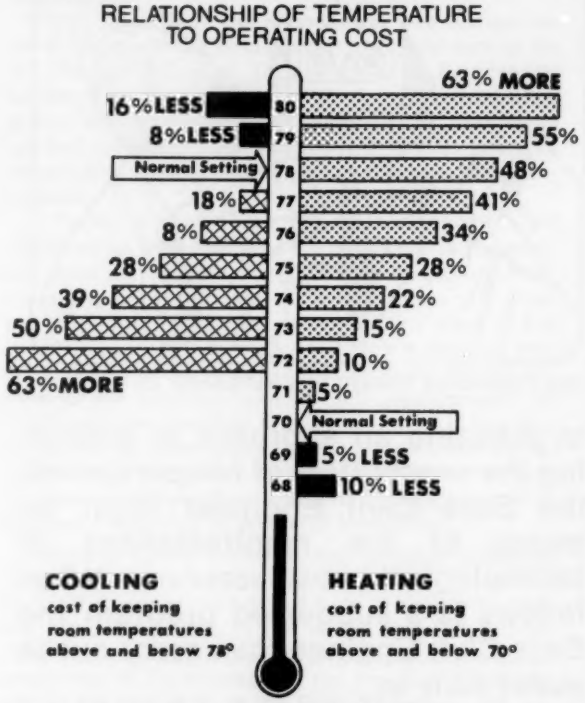
Selected for attendance at the Industrial College of the Armed Forces are David M. Cornell and Harry E. Halec.

Two alternates were also selected and they are Ralph Hodge and Dibrell Stowell.

Worth Noting

Chart Reveals How to Save on Heating and Air Conditioning

A significant personal motivation to contribution of the energy conservation effort should be a particular goal of Base Civil Engineers. The chart reproduced below defines the payoff obtainable by operating heating and air conditioning units at the **AFM 88-15** prescribed temperatures. It should be widely disseminated among the base population.



Training Program Taken to the Field Produces Results

When 34 base maintenance contractor personnel at Zaragoza AB, Spain, were scheduled to take the Headquarters US Air Forces in Europe (USAFE) sponsored generator maintenance course and aircraft arresting barrier course, an unusual problem was encountered. Few of the personnel knew or could speak English.

Instead of using teaching mockups and classrooms at Ramstein AB, Germany, MSgt William Murray and TSgt William Boffa, who are assigned to the barrier maintenance and ground power section at HQ USAFE, went to Zaragoza AB and conducted the classes in the field. With the assistance of an interpretor, most of the instruction was accomplished. In-place generators and BAK-9 and BAK-12 arresting barriers were used during the instruction.

The generator maintenance course was given to ground power personnel and the barrier maintenance course was presented to all ground power/barrier maintenance personnel in addition to members of the fire department.

Satisfactory scores were obtained by 100 percent of the ground power personnel in both courses and 100 percent of the fire department personnel attained a satisfactory score in the barrier maintenance program.

Maj Hubert Nethercot, Base Civil Engineer at Zaragoza AB, remarked that the training program was an "unqualified success."

Air Force Environmental Protection Exhibit at Fair

An Air Force Civil Engineering exhibit honoring the theme of the Expo '74 World's Fair in Spokane, Washington this past summer stressed the US Air Force position on environmental protection.

The exhibit illustrated the Air Force's concern for tomorrow's new environment by protecting our natural resources. Theme of the World's Fair was "Celebrating Tomorrow's Fresh New Environment."

Four panels made up the exhibit. Each presented a different view of the Air Force's environmental protection program. The initial panel saluted the World's Fair; the second portrayed the Air Force's Pledge to Environmental Protection; and the remaining two panels revealed the concern and actions of the Air Force in the areas of air quality control, noise abatement, solid waste management and pure water. Other areas covered were fish and wildlife conservation, beautification, forestry management and land and water management.

The exhibit summarized the Air Force's position with quotes from Executive Order 11514 and **ARF 19-1:** "USAF Commanders . . . eliminate, reduce, or control pollutants resulting from Air Force operations."

Our modern Air Force Civil Engineering society is based on a dynamic technology. It is reinforced by the fruits of science, construction experiences and the set of prevailing domestic and international conditions within which the Air Force must function in order to fulfill its assigned purposes. In this society, dynamic change is the norm and the veteran design Air Force Civil Engineer (AFCE) must accept it as a way of life. Though many AFCE designers are cognizant of this, only a few function in an environment that is designed to keep them abreast of changing concepts occurring in their particular specialities. Consequently, some AFCE designers have resigned themselves to a fate of stagnation because they have confused stagnation with stability, a lack of motion with the holding of a steady course, and activity with accomplishment. Any one of these breeds the germs which subtly degenerates an outstanding designer into a state of "technological obsolescence."

If it were possible for the designer, particularly one who matriculated 10 years ago or earlier, to view a rerun of his development from college to the present, he would witness the influential forces of dynamic change in action and the simultaneous change of many technical areas which affected the Air Force Civil Engineering society.

For example, the designer would see his alma mater passing through, not only physical changes with new buildings and a larger stadium, but academic ones as well. In short, he would see the philosophy and practices of architectural and engineering education undergoing major changes.

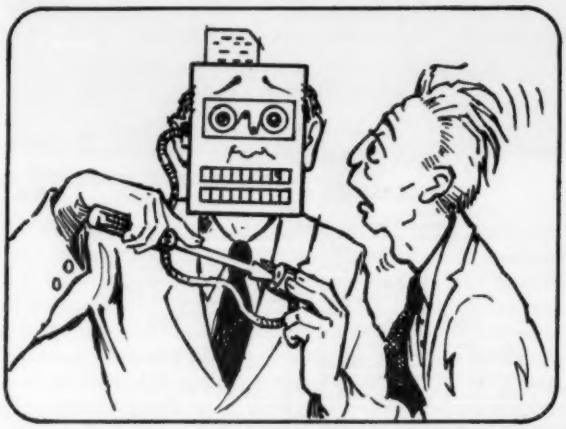
He would also observe drastic changes occurring in areas such as air field design and construction, protective coatings, expeditionary facilities and systems for contingencies, environmental pollution, data processing, and maintenance and repair programs for existing assets. All of these are the consequences of the continual changing domestic and international conditions.

The impact of these changes has had two significant effects on Base Civil Engineering activities throughout the Air Force.

First, it has caused large civil engineering activities to increase the specialization of the designer and fall into the trap of evaluating his service to the activity by the degree of his specialization. By doing this, the designer's ultimate value to the organization has been reduced and his future growth restricted. Designers in this category who possess specialization in great depth must be constantly aware of their need to continuously broaden their base of knowledge to sustain their value to the design effort.

Second, the opposite danger has occurred to the designer in the small civil engineering activity, that is, he is the jack-of-all-trades with no specific ability in discipline. As a result, the designers in many of our smaller organizations have been spread so thin that their knowledge has become broad, but shallow. Designers here must continuously improve themselves by constant study in specialized areas of their profession. Too often, the generalist is unaware of the changes taking place in his profession and soon becomes of little value to his organization as he grows more "technologically obsolete."

From these remarks, one could easily conclude that the designer must be retrained at least once during his lifetime. This conclusion is further backed by the belief of management engineering analysts that the need for one complete re-education during a lifetime goes for every profession. This is particularly true and difficult for the AFCE designer, whose profession is constantly changing. Thus, after 10 years service, the designer is scarcely able to recognize the playing field on which the game proceeds. In brief, he can't provide the vital facilities and systems needed to satisfy the Air Force's objectives.



The "Jack-of-All Trades" with No Specific Ability.

In planning an approach to extending the capabilities of his personnel, the Base Civil Engineer must be aware of the manifestations of technological obsolescence. What follows is a suggested program the Base Civil Engineer can carry out to assist him in

Keeping Personnel Technologically Current

by Maj James G. Smith, Jr, PE

At this point, one should ask the question, "Who is responsible for insuring that designers are kept abreast of the important innovations applicable to Air Force Civil Engineering?" We turn attention to this question.

One well-founded observation is that professional growth and development of the design AFCE is the responsibility of the individual since the certainty of his continued development is directly correlated to his mental capabilities, his initiative, and most of all, his willingness to make the effort.

Second, since the Base Civil Engineer (BCE) has much to gain from the continuing development of his designers, it could be postulated that the prime responsibility should rest on him to develop an environment that will motivate his designers to continue their development.

Third, since there can no longer be two distinct entities, academic and field design, one could turn to the Air Force Institute of Technology Civil Engineering School at Wright-Patterson AFB, Ohio. The School is a source which provides the leadership in developing tailored courses to meet the needs of AFCEs in lieu of developing courses that are part of some on-going curriculum.

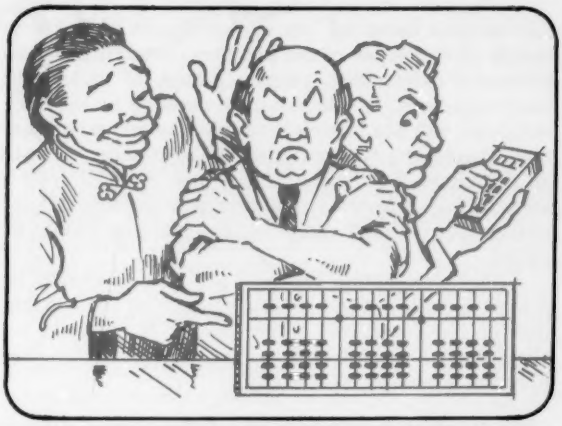
Finally, one might say that the Directorate of Civil Engineering, Headquarters US Air Force is responsible, since it is the coordinate voice of the active AFCE. Certainly, one should expect the Directorate to encourage extending the designers capabilities since it has an inherent responsibility for instilling a sense of professionalism in the designer that prompts him to implement his constant need for self-improvement. As the Directorate succeeds in this task, there is less of a burden on the subordinate organizations about the obsolescence of designers, for they will be self-motivated towards professionalism which is synonymous with continued updating of technical knowledge.

Having briefly reviewed four possible answers, the question arises again, "Who is primarily responsible?" The answer must be all four, in their own time and place. Even though the aforementioned sources share the responsibility in varying degrees, the initial beneficiary of the extension of the designer's capabilities or the lack of it, is the BCE. Therefore, the remaining discussion addresses a basic program which the BCE can carry out to keep his designers "technologically current."

In planning an approach to extending the capabilities of the designers, the BCE must be keenly aware of the various manifestations of technological obsolescence; he also needs to understand the type of individual he hopes to save from its adversities.

First, manifestations of technological obsolescence act in insidious ways. For example, as a BCE, is there any doubt that the quality of a designer's work is satisfactory or, if not unsatisfactory, is the quality of his work not quite up to expectation? Is the designer's volume of work slow or insufficient? Is there any question regarding the potential of a designer's future growth? Is the time required to correct a designer's errors excessive? Is there a feeling of apathy on the part of designers? Is there a trend of repetitive underestimating of project scopes and construction project costs? If the answer to any of these questions is "yes," the BCE should not pass off the reasons for his response lightly because a "yes" reply is a symptom of the presence of technological obsolescence.

Second, recognizing the pitfalls of drawing conclusions from generalizations or creating a composite person from individual human beings, the BCE must nevertheless define the "average designer." From a technical viewpoint, the "average designer" is the BCE's life-blood who creates new and better real property facilities and systems. He likely has a baccalaureate degree, has been out of college more than 10 years, and has professional registration status. Conversely, he is not active in a professional society, does not hold an advanced degree, or is not involved in programs of continuing education. Socially, he is fairly stable, having been with the Air Force at least seven years, earning an acceptable salary, married, owning his home, and active in social affairs. The foregoing comments do not present a picture of an aggressive AFCE advancing his professional status; however, they do present a challenge to the BCE to find a way to stimulate him to excellence.



The Generalist: Unaware of the Changes Taking Place.

The BCE must stimulate his designers by identifying the deterrents which keep them from actively pursuing continuing education programs; he must organize efforts to circumvent these obstacles. Major deterrents might include: no feeling on the designer's part of an urgent need to make the effort; management has not communicated the necessity of positive action to the designer in the self-development area; the designer's doubt as to his ability to understand and absorb new technology; the designer's reluctance to admit the need to learn new techniques and technology; unwillingness or inability to give up personal time; and the designer's lack of realization that his technical ability needs expansion.

Once the designer has been defined and the deterrents bypassed, the BCE must make a sound judg-

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ment as to what materials will be most useful to his designers' upgrade.

A long list of topics can be written to strengthen the designers' contributions. Compiling a list is not an easy task. It will require a review of the BCE's objectives, opinions of outside persons, recommendations by the designers themselves, and some genuine brainstorming techniques.

When the list has been compiled, it will become obvious that there are not enough hours available to satisfy all the hopes of the planners; thus, it becomes necessary to establish priority groups of topics and time sequences. It will require a decision as to which designers will need specialized material and what general, broadening type material will be of most value to all designers. Furthermore, this material will need a set schedule of reviews to determine if the original decisions are still valid and what new material should be added.

After completing the list, one person should be placed in charge of the program to extend the capabilities of the designers. If one person is not held accountable for this effort, it will be diluted in the ever-pressing problems of the day.

First Test for the BCE

The possible response from a BCE at this time is that it is an expense that cannot be afforded. Here is the first test of the BCE's recognition of the importance of stimulating his designers to greater contributions. Is the BCE willing to let nature take its course and expect that creative, forward-looking designers will evolve by their own initiative? Unfortunately, human nature and history do not give credence to this hope.

The final but very difficult step is to determine how the upgrade material is to be conveyed to the designers. Many proven techniques can be used to convey the material; however, the following two broad categories are most responsive to the AFCE's needs: sources outside the BCE's organization and in-house activity. The choice will depend on the subject matter, the location of the base, available talent and time within the organization, the funds available for the activity, and the persons to be involved in the education process.

Some specific techniques follow which the interested BCE can adopt, taking into consideration his own situation. The techniques are categorized under the two broad groups previously mentioned.

Outside sources may be from within the Department of the Air Force: Civil Engineering School, Civil Engineering Center, technical schools, and the Air Force Systems Command. Other Federal outside sources might include: US Corps of Engineers, Naval Facilities Engineering Command and the Environmental Protection Agency. Non-governmental outside sources may also provide valuable services: local colleges of engineering or extension branches, special seminars, professional societies, consultant firms, and industrial manufacturers and suppliers.

In-house activities may be provided through special programs conducted by qualified in-house personnel; seminars on new materials, products and methods; reading of technical magazines and papers; program learning; filmed lecture series; correspondence courses; and good in-house libraries with selected publications readily available to all designers.

A program consisting of materials and instruction from the suggested sources will be highly rewarding; however, first emphasis should be given to a combination of the in-house "do-it-yourself" and the Civil Engineering School programs. Presentations and informal discussions on technical information will also show management's interest in expanding technical horizons. The in-house programs also have the advantage of being more reasonable in direct cost and the use of productive time, which will be attractive to the BCE. However, if requirements dictate the use of the other sources, the BCE should not be at all reluctant to seek their services.

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In summary, a Base Civil Engineering organization that wants to extend its designers' capabilities must take positive action to overcome the reluctance of the individual designers. It must carefully analyze the make-up of its personnel with attention to background, capability and the personal obstacles of each individual. It must examine all ranges of information deemed necessary now and in the future, and identify the most useful and necessary support programs. It must review all the sources of education available and select those that will accomplish the most, taking into consideration the material to be covered and the persons to be involved. It should lean heavily first on in-house and Civil Engineering School programs, involving participation by the designer himself. It should avoid the temptation of picking one cure-all program for all personnel. The BCE must designate one person who will be charged with the task of continuing education and call on him at regular intervals to report progress.

The extension of design AFCEs capabilities cannot be left to chance. CE

Of the 2.4 percent of the nation's energy that the Department of Defense consumes, the Air Force uses 48.1 percent. Needless to say, energy conservation is one of the most perplexing issues facing Air Force Civil Engineers as well as the nation. It is

A Continuing, Challenging Objective

by Paul C. Land, PE

■ The serious fuel shortages of last winter appear to have been forgotten almost as soon as the gasoline lines disappeared. As the 1974 heating season approaches, however, we must be aware that energy conservation is still one of the most profound and perplexing issues facing Air Force Civil Engineers (AFCEs) as well as the entire nation.

Until last year the Federal government was not too concerned with energy conservation. Then the unprecedented fuel shortage of 1973, highlighted by the Mid-East Embargo of oil shipments to the US, ignited the realization that energy conservation constraints must be initiated at all levels of government: the White House, Congress and administrative agencies. The Presidential message of 7 November 1973 to the American public stressed that energy conservation was of paramount importance to the welfare of our nation. In the message, the President challenged governmental agencies to intensify their efforts on energy conservation and thereby set an example for the nation. At the President's request, responsibilities for energy policy within the Federal government were streamlined. The recent elevation of the Federal Energy Office to a Federal Energy Administration (FEA), should give significance to the development of a strong national program of energy conservation.

AFCEs are professionally involved in the design, construction, maintenance and operations of the vast complex of residential/industrial facilities in the Air Force. They should not only be well aware of the prime requirement for energy conservation but should also be well aware of on-going and planned governmental activities.

THE ENERGY CRISIS: The United States, with only six percent of the world's population, consumes 35 percent of the total energy annually. It also produces about 36 percent of the world's goods, but the economy requires a huge quantity of energy. Putting this problem into perspective, the US consumed 72 quadrillion BTUs of energy or an equivalent of 633 billion gallons of oil, or 72 trillion cubic feet of natural gas during 1973. This occurred at a time when there was some indication that exhaustion of oil and natural gas supplies was within sight. Other sources identify the huge demand for energy with a rapidly increasing population growth, an energy intensive economy and our generally inefficient ways of using energy. In either case, there is still a great need for energy conservation.

The nation's attention has been focused primarily on fuel shortages in the automotive/transportation area or in the rapidly increasing prices in crude oil. Approximately one-third of this huge annual requirement, **Figure 1**, is in the residential and commercial sector where energy conservation will result in substantial energy savings without appreciably affecting our life-style. According to information recently prepared by the Department of Defense (DOD) Energy Task Group, the DOD consumes only 2.4 percent of the nation's total energy, 48.1 percent of which is Air Force, **Figure 2**. This appears as a small portion of the total but it is the largest single demand, and therefore, quite conspicuous to the public. It is also interesting to note that 61 percent of the DOD's total energy consumption is for aircraft, ship and mobile ground operations. This not only limits our scope but makes our achievements in civil engineering even more important.

OUR OBJECTIVE: A brief review of several recent actions within the Federal government may have a favorable effect on our professional involvement during this era of energy conservation. Project Independence, which is an executive goal set forth as a national objective to make our country energy self-sufficient during the 1980s, is gaining momentum. At the highest level, vital energy conservation legislation has been introduced in the

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Challenging Objective *cont'd*

Senate and House of Representatives, or enacted into Public Law that will take great strides toward making our nation more energy wise. Two legislative actions, one designed to promote efficient utilization of energy resources and the other to accelerate the technology associated with solar energy, are exemplified as follows:

• The FEA Act of 1974, P.L. 93-275, 7 May 1974, created an administration (FEA) in the executive branch to promote efficient management of the nation's energy sources nationally. The Act, considered one of the most comprehensive laws in the energy conservation area, "declares that the general welfare, the common defense and security require positive and effective action to conserve scarce energy supplies; to insure fair and efficient distribution of, and the maintenance of fair and reasonable consumer prices for such supplies; to promote the expansion of readily usable sources; and to assist in developing policies and plans to meet the energy needs of the nation."

• The Solar Heating and Cooling Demonstration Act of 1974, P.L. 93-409, 3 September 1974, authorizes a $50 million, five year solar energy heating and cooling research and development project. It directs that an inter-agency cooperative program be undertaken to provide for combined solar heating and cooling of residential buildings in five years. Further, the bill provides for the demonstration projects to be extended to a wide range of commercial buildings such as school, industrial, office and agriculture structures.

The second step forward occurred when all Federal agencies accepted the energy challenge. Following executive leadership and legislative actions, existing policies for design, construction and operations of government buildings and facilities have been extensively reviewed. New criteria have been developed and forceful energy conservation programs have been initiated. Perhaps the most publicized guidelines were issued in January 1974 by the General Services Administration (GSA). The edict, FMC 74-1, specified that temperatures in Federal office buildings during working hours would be maintained at 65-68 degrees F for heating and 78-80 degrees F for cooling. In addition, lighting intensities were reduced.

The edict emphasized the compelling need to bring about immediate and long-term savings in the Federal energy budget. New, highly regarded energy documents, developed primarily to provide for energy conservation in new buildings, have been publically recognized as valuable aids for analyzing energy requirements and may become a source of expertise to the building industry. Documents similar to the following should not only decorate our library but be used to stimulate our thinking:

An in-depth report **Design and Evaluation Criteria for Energy Conservation in New Buildings** was prepared by the National Bureau of Standards (NBS) during the winter of 1973 in response to a request from the National Conference of States on Building Codes and Standards to provide technical assistance for a performance-type standard. The energy conservation features in this report may form the basis for the development of a national standard. The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) is sponsoring the criteria through the consensus procedures of the nation's voluntary standards generating systems. According to the original plan, ASHRAE would use the NBS document as basic energy conservation criteria, and hopefully complete an interim reference standard in 1974. The interim standard would then serve as the basis for the national consensus standard.

The criteria published by the GSA in March 1974 entitled, **Energy Conservation Design Guidelines For Office Buildings**, represents the combined efforts of architects and engineers from the private sector working closely with GSA's Public Building Service officials. The guidelines are keyed to methods which, if used in proper relationship to varying climatic conditions, are calculated to provide an energy "budget" of 55,000 BTUs per square foot per year of

HOW ENERGY IS USED-NATIONWIDE
PERCENTAGES BY MAIN SECTORS

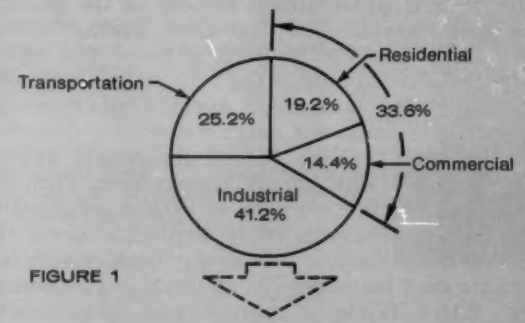

FIGURE 1

PRIMARY USES FOR ENERGY

RESIDENTIAL, COMMERCIAL		**33.6%**
Space Heating	17.9%	
Water Heating	4.0%	
Air Conditioning	2.5%	
Refrigeration	2.2%	
Lighting	1.5%	
Cooking	1.3%	
Miscellaneous	4.2%	
	33.6%	
INDUSTRIAL		**41.2%**
Process Steam	16.7%	
Direct Heat	11.5%	
Electric Drive	7.9%	
Electrolytic Processes	1.2%	
Miscellaneous	3.9%	
	41.2%	
TRANSPORTATION		**25.2%**
Fuel; except lubes and greases	24.9%	
Miscellaneous	0.3%	
	25.2%	
TOTAL		**100.00%**

NOTE: Miscellaneous includes End-use items less than 1% and Feedstocks, raw materials, used in the commercial, industrial and transportation sector.

energy input. Reportedly, the guidelines present a challenge to the designer's ingenuity to design energy efficient buildings, rather than a requirement to follow prescribed rules. The May 1974 issue of the AIA Journal contains a comprehensive checklist of opportunities for saving energy in office buildings, drawn from the GSA guidelines.

Effective energy conservation measures will require the combined efforts of all independent actions working together toward a common goal. To this extent government agencies are implementing energy-efficiency objectives, and in many cases, setting an example for the private sector. Illustrations, however, will magnify the importance of each potential accomplishment.

A variety of energy saving concepts was used to conserve energy and provide a laboratory for the installation of existing and innovative energy conservation systems, equipment and techniques in a new seven story Federal office building to be constructed in Manchester, New Hampshire. During the design phase, it was determined that one-third of the normal energy requirements would be saved through a more efficient design by: increasing the thickness of the building's thermal insulation, reducing the size of the windows and double glazing, and changing the shape of the building. Additional savings were affected by optimizing energy consuming heating, cooling and lighting systems. Altogether, an annual energy savings of at least 40 percent is anticipated when compared to the energy used in what was previously considered a typical office building.

The vital need for conservation of limited resources was evidenced in a contract recently awarded for the construction of 500 units of military family housing in the FY 1974 New Housing Construction Program at Langley AFB, Virginia. In a supplemental booklet, the contractor identified a number of significant energy saving features as a part of the contractural documents. These features included items that were over and above our normally strict energy conservation criteria. Items such as increased thermal insulating values, higher efficiency air conditioning equipment, forced air systems with energy economy cycle control, water-saving water closets, etc., were identified for efficiency and effectiveness by either product specifications or design considerations.

The unique possibilities associated with the use of solar energy as a supplement to the current energy crisis has attracted wide public exposure, particularly through the media of television, newspapers, technical publications, etc. An example of this technology in

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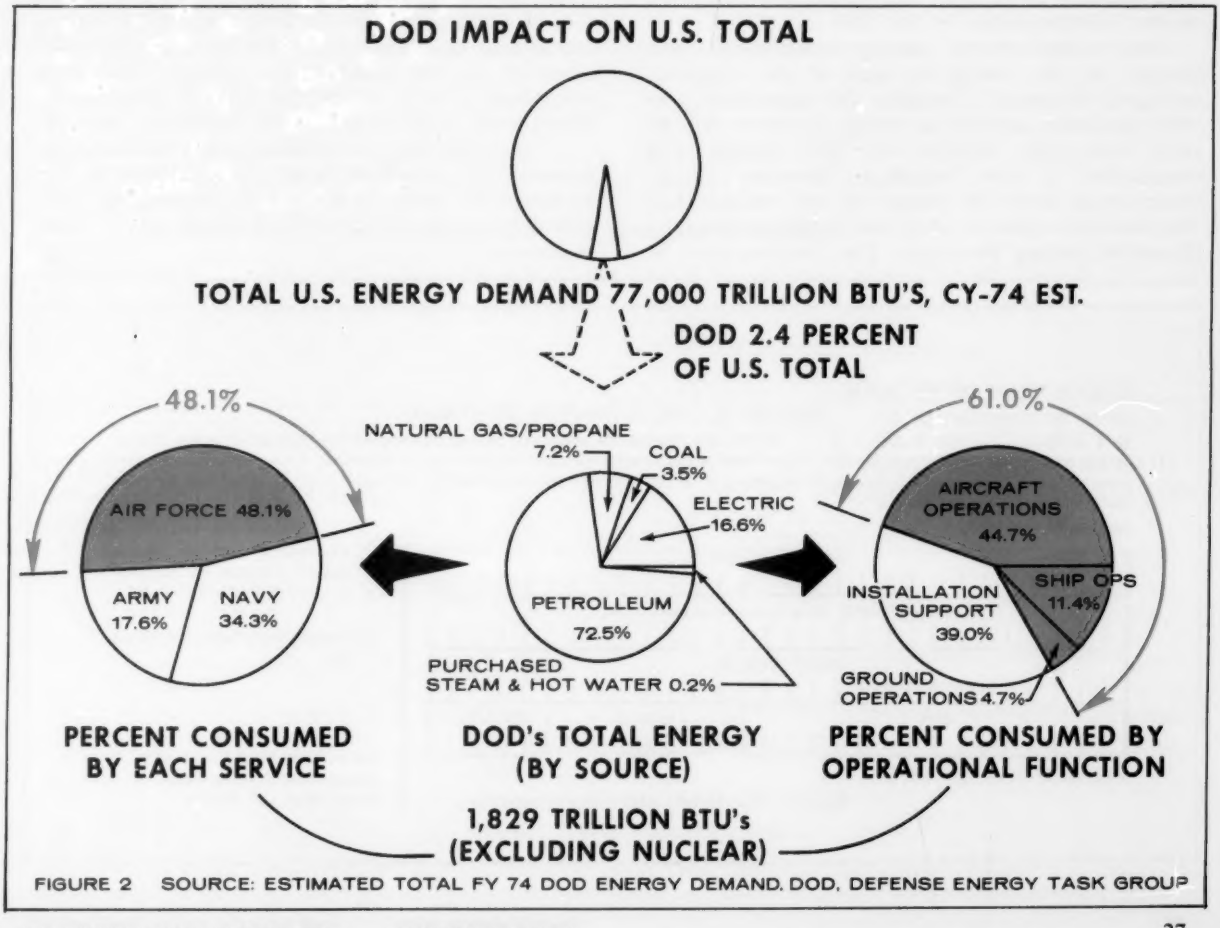

FIGURE 2 SOURCE: ESTIMATED TOTAL FY 74 DOD ENERGY DEMAND, DOD, DEFENSE ENERGY TASK GROUP

Challenging Objective *cont'd*

action will be measured in a large 50,000 square foot office building under construction in Saginaw, Michigan. The building will contain a solar energy collector system that will satisfy all requirements for domestic hot water heating and provide for 60 percent of the building's heating requirement. A solar powered cooling system may be added at a later date. Interesting energy conservation design features include dual-glazed windows protected from solar heat gains by large overhangs and the use of low wattage lighting systems in the building.

An important interagency effort in the energy conservation resource-use area is the development of a Modular Intergrated Utility System (MIUS). The system conserves fuel through recovery of energy normally wasted when essential utility services are supplied from separate sources. MIUS recycles energy by packaging into one processing plant all of the five utility services: electricity, space heating and air conditioning, solid waste processing, liquid waste processing and residential water purification. A partial system, involving the energy elements of MIUS, has been installed at a HUD-insured residential complex in Jersey City, New Jersey, and has been in operation since January 1974. Data are being collected from on-site instrumentation by the NBS.

One central theme, energy conservation, was inherent in the design in each of the examples previously discussed. Certainly, the opportunities to effect maximum savings in energy resources will be most frequently realized in the design and construction of new buildings; however, energy conservation cannot be limited to new construction. This becomes apparent when one compares the ratio of new to existing structures. The criterion must be applied to each existing building, individually and/or collectively in order to achieve realistic energy-saving objectives. Each application, in turn, must be practical and economical, and costs must be amortized within a reasonable time period. The individualized professional involvement of the architect and the engineer will be required as each specific energy conservation measure is applied to a particular building, site or system. This involvement is certain to expand as both the demand for energy and the concurrent search for an energy-savings methodology increases.

We are moving forward! The Air Force is keenly aware of the current energy problem and the great need not only to conserve existing energy, but also to develop as soon as possible new sources available within the United States. For many years the Air Force with its expressed desire for long range reductions in energy sources and the use of the latest technological advances in the construction industry has been recognized as a leader in the Federal government. These goals must be even more vigorously pursued:

"We must achieve maximum reductions in energy consumption, consistent with: an acceptable human environment, sound principals of engineering, cost effectiveness and the appropriate utilization of natural resources."

CE

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